# Appropriate Measures of Product Market Competition for Developing Countries

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*Abstract— Competition measures are categorized into two major groups, including structural and non-structural measures. Although estimating structural indicators is simple, it requires information relative to market share or the number of firms in the market that are often unavailable in developing countries. In contrast, non-structural measures may be more appropriate for estimating competition in developing economies. Non-structural indicators do not impose stringent data requirements (i.e., market share and defining relevant markets). They require information regarding business results, and even in some cases, they do not need product price information (i.e., Boone indicator and Rent index). Among the non-structural measures, the Boone indicator may be the most suitable one since it has more advantages than the non-structural metrics. Besides, it is estimated by simple linear econometrics, thereby calculating and interpreting easily.*

*Keywords— Competition, product market competition, measure, indicator, developing countries.*

## I. INTRODUCTION

Product market competition is greatly meaningful for competition authorities and policymakers to inform decision-making (OECD, 2021). Additionally, it is also one of the most powerful corporate governance tools in motivating managers to increase firm value (Babar & Habib, 2021). On the macro side, market competition impacts the government's objectives, such as monetary policy, financial stability, international competitiveness, productivity, or economic growth. Competition intensity can inform a wide range of possible actions, such as removing barriers or imposing restrictions to increase or reduce it. Thus, measuring the intensity of product market competition is immensely valuable and results in numerous metrics. The competition measures vary in complexity, reliability, and ability to provide information, leading to differences in their application requirements.

In fact, competition is a complex concept, so it is hard to observe and calculate straightforwardly. The measurement of competition is generally categorized into two major streams, including structural and non-structural measures. The structural indicators are based on the Structure-Conduct-Performance (SCP) paradigm discussing market structure-performance linkages (e.g., k-firm concentration ratio (CRk), Herfindahl-Hirschman Index (HHI), Hall-Tideman index (HTI), etc.). Concretely, concentration indexes mention that the likelihood of collusion increases with market concentration, thereby significantly changing firm performance. Non-structural measures (i.e., Lerner index, Rent

index, H_statistic, Boone indicator, etc.) are formed on the New Empirical Industrial Organization (NEIO) theory that assesses and estimates firm competitive conducts. The more accurate the measures are, the more precise the empirical results are. Although competition indicators can provide useful information, they also have limitations. Hence, one of the grand challenges is to find out appropriate competition indicators, especially for developing countries.

Distinct from the developed countries, most developing countries lack access to big data, have poor quality data, and are full of risks in collecting primary data. There are divergent reasons that cause unavailable data in developing economies. Governments often lack incentives to collect, share and use data since they have to devote more efforts and time to eradicate poverty and hunger. A few of them have poor data systems. Meanwhile, finding out solutions to social and economic problems is inseparable from the statistics. Good data are essential for government and national institutions to plan, fund accurately, and evaluate the development of a country, especially market competition. Besides the secondary data, collecting primary data in developing countries has potential risks such as low reliability, low response rate, political risks, and lack of funds. These risks may lead to biases in estimation. Therefore, it is worthwhile to have empirical studies on the appropriate measures of product market competition for developing countries.

To inform the debate on how competition indicators should be used in developing countries, this paper reviews the literature on competition measurement to point out the most appropriate measures. The paper focuses on comparing competition indicators to enable critical issues concerning their usability in developing countries. This paper proceeds as follows. Section 1 introduces it, followed by concepts and measures of competition in Section 2. Then, Section 3 shows the characteristics of data in developing countries. Section 4 discusses appropriate methodologies to measure competition in developing countries. Finally, section 5 concludes the paper.

## II. CONCEPTS AND MEASURES OF COMPETITION

Although the concepts of competition are complex, they are generally categorized into two major groups, including competition as a static state and competition as a process of rivalry. According to the standard economic theory, competition is identified as an equilibrium condition itself (Cournot, 1938) instead of the process toward equilibrium in

the long-term (Smith, 1776). In other words, it is a static end-state in which firms cannot persistently overcharge and earn abnormal profits, called static competition state. The requirements of this static competitive situation are having a considerable number of rivals, participants owning market competition knowledge, and entering or exiting freely (Cournot, 1938).

The SCP paradigm was later developed based on the static concept of competition (Mason, 1939; Bain, 1956). The paradigm tries to explain how market structure (i.e., number of firms, market share, entry and exit conditions, and level of product differentiation) impacts firm performance. Market structure first affects firm conducts (i.e., pricing strategies, product quality, advertisement expenditure, collusion, etc.). Then performance is changed indirectly. According to the SCP paradigm, the more concentrated an industry is, the higher the firm performance is since it is easier to operate in an anti-competitive manner. Distinct from the static concept, competition as a process of rivalry reflects the behavior of firms in dealing with competitors (OECD, 2021). Firms are engaged in a dynamic competitive process that less efficient firms are removed, or their market shares are switched into more efficient incumbents.

TABLE 1. Structural measures of competition

| Measures | Formula | Explanation | Studies |
|---|---|---|---|
| Concentra_ tion ratio of the k largest firms (CR$_k$) | $$CR_k = \sum_{i=1}^{k} s_i$$ s$_i$: market share of firm i | CR$_k$ measures the market shares of the top k firms. The index takes 0 for perfect competition and 1 for concentrative markets. | White (1982); Casu & Giradone (2006); Djolov (2013); Skuflić *et al.*. (2015) |
| Entropy (EI) | $$EI = \sum_{i=1}^{n} s_i \ln\left(\frac{1}{s_i}\right)$$ s$_i$: market share of firm i | Entropy takes 0 to indicate monopoly, and ln(n) in the condition of perfect competition. | Jacquemin & de Jong (1977); Ginevičius & Čirba (2007); Škuflić *et al.* (2015) |
| Herfindahl-Hirschman index (HHI) | $$HHI = \sum_{i=1}^{n} s_i^2$$ s$_i$: market share of firm i | The index ranges from 0 to 10,000. A market is competitive, moderately concentrated, or highly concentrated when HHI is less than 1,500, from 1,500 to 2,500, or over 2,500, respectively. | Slade (2004); Škuflić *et al.* (2011); Giachetti (2013); Fosu (2013); Škuflić *et al.* (2015) |
| Hall-Tideman index (HTI) | $$HTI = \frac{1}{2\sum_{i=1}^{n} i.s_i - 1}$$ s$_i$: market share of firm i | HTI ranges from 0 to 1. Its value close to 0 indicates perfect competition, while the value close to 1 for monopoly. | Hall & Tideman (1967); Bailey & Boyle (1971); Bikker & Haaf (2002) |
| Hannah & Kay index (HKI) | $$HKI = \left(\sum_{i=1}^{n} s_i^{\alpha}\right)^{\frac{1}{1-\alpha}}$$ $(\alpha > 0; \alpha \neq 1)$ s$_i$: market share of firm i $\alpha$: elasticity parameter | *HKI* is sensitive to the parameter $\alpha$. For $\alpha$ close to 0, HKI will move like the number of firms in the market. For $\alpha$ close to $\infty$, the index converges towards the reciprocal of the market share of the largest firm. | Hannah & Kay (1977); Bikker & Haaf (2002) |

*Source*: Authors' own aggregation (2021)

Two main approaches for measuring competition are structural and non-structural indicators. The structural metrics estimate competition as a static state, while the non-structural indicators measure competition as a process of rivalry. The structural indicators commonly used in empirical studies are shown in Table 1. The structural measures are based on the SCP paradigm, which lacks a theoretical foundation to support the notion that higher market concentration leads to lower competition. The paradigm and its associated concentration indexes suffer from major limitations. The contestable market theory argues that a concentrated market can be intensely competitive (Baumol, 1982). In concrete, a few firms which dominate the market may compete with others to get into the leadership position. The threat of entry can generate pressure on incumbents and keep the sector competitive.

According to the SCP paradigm, intense market concentration leads to higher firm profits due to collusion. Meanwhile, collusion may even exist in competitive markets (Bernheim & Whinston, 1990). In concrete, collusive behaviors can come from changing the relative costs and advantages of cooperation. In addition, concentration measures depend on the attribute carriers and have no background to classify into discrete and cumulative parts. The weights of attribute carriers are determined subjectively (Ginevičius & Čirba, 2007). Moreover, another drawback of concentration indicators concerns the appropriate definition of the market. It is difficult to determine the relevant geographical market (local, regional, or national) and the product market (Shaffer, 2004a, 2004b). In practice, defining the relevant market is often constrained by data unavailability. Thus, concentration indicators are more appropriate for identifying market structure than measuring competition.

In contrast, non-structural measures are commonly used in empirical studies. They are based on the NEIO literature, overcoming the drawbacks of concentration indicators. The NEIO estimates product market competition by directly observing the conduct of firms in the market. The NEIO uses a variety of alternative methodologies requiring different data and assumptions. Distinct from the structural measures, the non-structural ones have a firm theoretical foundation to support the concept that higher market competition means lower concentration. The key insights of this theory are to focus on firm conducts and the dynamics of markets, so the NEIO captures proactive and dynamic competition that the structural metrics often overlook.

TABLE 2. Non-structural measures of competition

| Measures | Formula | Explanation | Studies |
|---|---|---|---|
| Lerner index | $Lerner = \dfrac{P - MC}{P} = \dfrac{1}{\left|e_{Q_D,P}\right|}$ <br><br> $(0 \leq Lerner \leq 1)$ <br><br> P: firm price <br> MC: the marginal cost <br> $e_{Q_D,P}$ : price elasticity of demand <br> $(1 \leq e_{Q_D,P} \leq \infty)$ | $0 \leq Lerner \leq 1/\left|e_{Q_D,P}\right|$ <br> The Lerner index ranges from 0 in the situation of perfect competition to 1 in the situation of monopoly. | Lerner (1934); Pruteanu-Podpiera và *ctv.* (2008); Polder & Veldhuizen (2012); Obembe & Soetan (2013); Liu và *ctv.* (2013); Assefa và *ctv.* (2013); Arrawatia & *ctv.* (2014) |
| Rent | $rent = \dfrac{(EBIT - CC \times TA)}{FS}$ <br> EBIT: profits before interest payments, tax, and depreciation. <br> CC: the costs of capital <br> TA: total assets <br> FS: firm sales | Rents present the market power. Firms operating in less competitive markets should be able to sell their products well and earn higher rents. | Nickell (1996); Pant & Pattanayak (2010); Beiner *et al.* (2011); Obembe & Soetan (2013); Mnasri & Ellouze (2015) |
| Hstatistic | $\ln(TR) = \alpha + \sum_{k=1}^{K} \beta_k \ln(w_k) + \sum_{l=1}^{L} \gamma_l Z_l + \varepsilon$ <br><br> $H_{Statistic} = \sum_{k=1}^{K} \beta_k$ <br><br> TR: total revenue <br> $w_k$: the price of $k^{th}$ input <br> $Z_l$: a set of control variables <br> $\beta_k$: elasticities of the total revenue | H-statistic ranges from $-\infty$ to +1. The greater the transmission of cost changes into revenue changes, the more competitive the market is. It takes 1 for a competitive market and 0 or negative values for a concentrative market. | Panzar & Rosse (1987); Vesala (1995); Weill (2004); Memic (2015) |
| Boone indicator (BI) | $BI = \dfrac{\partial \ln \pi}{\partial \ln MC}$ <br><br> $BI = \dfrac{\partial \pi / \pi}{\partial MC / MC} \equiv \dfrac{\Delta \pi / \pi(\%)}{\Delta MC / MC(\%)}$ <br> $\pi_i$: firm profit <br> $MC_i$: the marginal cost | The index (BI) is the percentage drop in profits of firm i as a result of increasing a percentage in the firm's costs. High absolute values of the Boone indicator mean that competition is intense | Boone (2008); Tabak *et al.* (2012); Fosu (2013); Alhassan & Ohene-Asare (2016); Tan (2017); Moyo (2018); Albaity *et al.* (2019) |

*Source*: Authors' own aggregation (2021)

## III. DATA IN DEVELOPING COUNTRIES

Data play a vital role in supporting both governments and enterprises to forecast, plan, and conduct strategies. Good data allows firms to establish baselines, find benchmarks, set performance goals, and measure results. On the macro side, governments use data as a critical resource to improve operations and drive innovation. Finding out solutions to social and economic problems is inseparable from statistics. Data are essential for government and national institutions to plan, fund accurately, and evaluate the development of a country. In addition, data also provide specific and measurable results. Thus, developed countries often invest greatly in thriving and accessing good-quality data. Distinct from the developed economies, most developing countries lack access to big data, have poor quality data, and are full of risks in collecting primary data (Chapman & Boothroyd, 1988; WHO, 2003).

In fact, divergent reasons cause unavailable data in developing economies. Governments of most developing countries often lack incentives to collect, share and use data since they have to devote more efforts and time to eradicate poverty and hunger. A few developing economies have poor data systems. Concretely, the paucity of accurate, reliable, and timely data has been a recurring issue in developing countries. Therefore, the measures applied in developed economies may be of limited use in developing ones (Hoskisson *et al.*, 2000) since significant economic gaps result in data differences. Besides the primary data, collecting primary data is full of risks. Due to a lack of funds, governments and institutions in developing countries have fewer incentives to collect data,

especially primary data. Moreover, conflicts and political instability in developing countries seriously affect the collection and aggregation of data. Response rates of conducting research in the countries are often low, thereby obtaining missing data. Those reasons result in low reliability and poor quality of data in developing countries.

## IV. MEASURES OF COMPETITION FOR DEVELOPING COUNTRIES

Developing countries often lack access to big data analysis, have poor quality data, and are full of risks in collecting primary data. The major disadvantage of concentration indicators is their data requirement. The structural measures are based on the SCP paradigm, which lacks a theoretical foundation to support the notion that higher market concentration leads to lower competition. Moreover, collusive actions may be sustained even in the presence of many firms (Bernheim & Whinston, 1990). Concretely, multimarket contacts may increase incentives for collusion by changing the relative costs and benefits of cooperating. Thus, concentration indicators are hard to be used in developing economies. Nevertheless, the non-structural measures (i.e., Boone indicator, Rent, H-statistics, and Lerner index) are commonly used in most empirical studies in developing countries (Pant & Pattanayak, 2010; Obembe & Soetan, 2013; Fosu, 2013; Arrawatia *et al.*, 2015; Alhassan & Ohene-Asare, 2016; Albaity *et al*., 2019). The non-structural indicators are based on the New Empirical Industrial Organization theory (NEIO), which helps avoid potential drawbacks of concentration indexes. They do not impose stringent data requirements (i.e., market share and defining relevant markets). They just require

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information regarding business results, not even need price information (e.g., Boone indicator and Rent). Besides, they are estimated by simple linear econometrics, so it is easier to calculate and explain them.

In concrete, Rent index is firm rent from production and other business activities, measured by the profits before interest payments, tax, and depreciation (EBITDA) minus capital costs multiplied by total assets and standardized by firm sales (Forbes *et al*., 2001; Koke & Renneboog, 2005; Pant & Pattanayak, 2010; Beiner *et al.,* 2011). Rent indicator can be interpreted as an ex-post measure of market power, reflecting the extent of competition a firm faces. Firms only create higher rents if they operate in a less competitive market. In a highly competitive environment, rents from production activities will be low. The approach of Rent indicator requires the assumption of uniformity of wage rate in a particular industry. Rent index may be appropriate for conducting research in developing countries due to its simple estimation and not requiring good quality data. It only needs information on business results. The main shortcoming of Rents is having a strong correlation with profitability. If dependent variables are directly calculated by firm profits, the studies may suffer a positive bias if using Rent to measure product market competition.

H-statistic, called Panzar and Rosse (PR) indicator, is the sum of the price elasticities of firms' total revenues. According to the Panzar and Rosse model, H-statistic ranges from $-\infty$ to $+1$ (Table 2). The higher this index is, the fiercer the market competition is. H-statistic may be suitable in studies with a limited number of observations, which is one of the data characteristics in developing countries. However, calculating H-statistics is sensitive to monopsony power. Monopsony power tends to obtain higher values of the H-statistic, masking any market power present on the output side (Shaffer, 2004a). Additionally, inputs should be homogenous and their prices exogenously fixed. Nevertheless, the prices of products are not always exogenous. The indicator also neglects dynamics in the market and non-pricing strategies. In fact, H-statistic may take negative values, even if the market is highly competitive. Moreover, interpreting H-statistic depends on the assumptions of the market equilibrium, demand elasticity, and cost function (Panzar & Rosse, 1987; Bikker *et al.*, 2012). However, those assumptions are unable to be tested in practice, except for the market equilibrium. In other words, H-statistic is a continuous monotonic index in terms of conduct, so interpreting it is more complex than in the standard Panzar and Rosse model (Shaffer, 2004b).

Lerner index is the price-cost margin, a market power indicator. The main advantages of Lerner are straightforward interpretation and low data requirement, which is remarkably appropriate for estimating competition in developing countries. In addition, Lerner allows researchers to measure market power in different relevant markets, including geographical and product markets. Despite its benefits, Lerner still has some shortcomings. It is more appropriate for measuring market power than estimating competition. A high value of the Lerner index may result from an increase in the average price-cost margin, not implying a low level of

competition (Bulow & Klemperer, 2002). The average market power may rise due to the reallocation effect, even if individual Lerner indices decline (Boone *et al.*, 2013). In other words, the average Lerner index can go up if the surge of more efficient firms' market share equalizes or overcomes the reduction of individual Lerner indices. Another benefit of Lerner is easily applied to industry aggregate data that are more available than firm-level data (Leon, 2014).

The Boone index, called the profit elasticity, is a new approach used commonly in recent empirical studies (Moyo, 2018; Khan & Hanif, 2017; Boone *et al.*, 2013; Boone, 2008). It avoids major theoretical drawbacks of price-cost margin measure - Lerner (Boone, 2008; Boone *et al.*, 2013). Boone index is the percentage drop in firm profit when the marginal cost rises by one percent. In a highly competitive market, a one percent increase in marginal cost leads to a more than one percent decrease in profit. The main advantage of the Boone indicator is the ability to capture market dynamics and be appropriate for samples having a limited number of observations. Another advantage is that it suits all relevant markets because a cost increase always leads to a decline in profits.

In addition, the Boone index is appropriate for studies in developing economies that often have data of poor quality (Leon, 2014). This indicator only requires information regarding profits and costs. If costs are measured by average costs, the calculation of the Boone indicator does not require information on prices (Leon, 2014). Moreover, the Boone index is estimated by a simple linear econometric, including one equation with one exogenous variable. Moreover, the Boone indicator monotonically presents competition, while determining competition through the Panzar and Rosse model is hard. Since the Boone indicator gives critical assumptions regarding the intensity of a market, it may capture the market more precisely, which leads to better competition estimates (Schiersch & Schmidt-Ehmcke, 2010). Although every indicator has its own advantages and drawbacks, the Boone index brings more benefits than the other mentioned non-structural measures.

V.    COMPETITION IN VIETNAM – A TYPICAL DEVELOPING COUNTRY

To confirm the valuable usage of the Boone indicator in developing countries, we conduct a case study in Vietnam - a typical developing economy. Our sample includes 352 firms listed on Vietnam's stock exchanges in 2015-2019, totaling 1,760 firm-year observations. Product market competition in Vietnam is measured by the Boone indicator. The mean Boone indicator is 0.95, with a standard deviation of 0.65. Competition in this country was a downward trend during the studied period (Fig. 1).

The mean competition is 1.04, 1.06, and 0.58 for the manufacturing, trade, and service sectors, respectively (Fig. 2). The findings indicate a gap in the mean competition among the sectors, consistent with the previous findings of Nguyen *et al.* (2013) and Malesky *et al.* (2020). The competition in the service sector is the lowest, while the highest competition is in the trade sector. The most critical service resource is human

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resources which are often considered valuable, rare, irreplaceable, and hard to imitate (Barney, 1991). Managing and using appropriate human resources may help service firms to gain their own sustained competitive advantages. Therefore, a firm is difficult to imitate the services of its competitors perfectly, leading to lower levels of competition in the service sector.
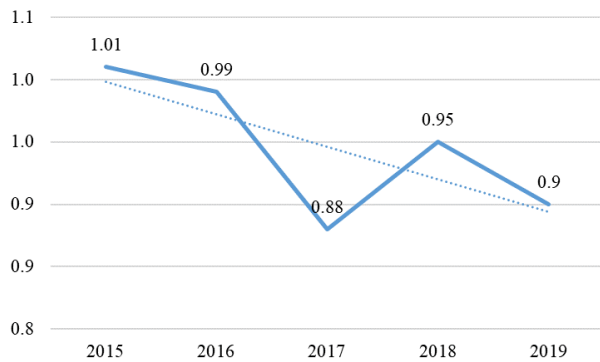


Source: The authors' calculation out of own dataset.
Fig. 1. Product market competition in Vietnam from 2015 to 2019
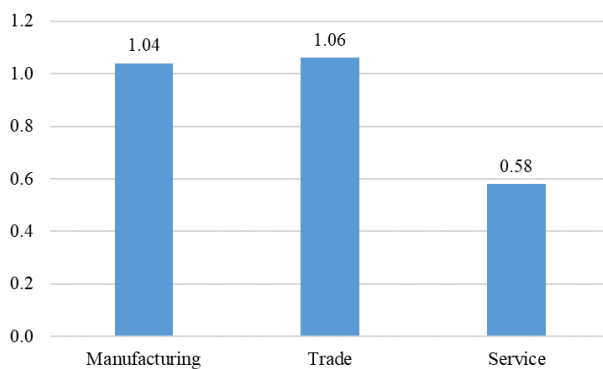


Source: The authors' calculation out of own dataset.
Fig. 2. Product market competition by sector in Vietnam

Additionally, service markets are less integrated and competitive than markets for goods since the typical characteristics of service are less tradable and have a lower scope for standardization (OECD, 2005; Monteagudo & Dierx, 2009). Moreover, regulatory obstacles in Vietnam's service sector (i.e., licensing of professional service suppliers, rules making on investment, restrictions on the movement of people, regulatory transparency, etc.) may be barriers to entry, thereby limiting product market competition in this sector (Benz *et al.*, 2020).

According to The Heritage Foundation, Vietnam's economic freedom score is 58.8, making its economy the 105th freest in the 2020 Index. In the Asia–Pacific region, Vietnam is ranked 21st among 42 countries. This country's economic freedom score in 2021 is 61.7, making its economy the 90th freest in the 2021 Index and ranked 17th among 40 countries in the Asia–Pacific region. Vietnam's economic freedom score is the 84th freest in the 2022 Index and 18th among 39 countries in the Asia–Pacific region. The upward trend of the economic freedom score reveals the improvement in economic reform and openly invites the involvement of households and firms of

all ownerships. However, upgrading the investment environment is slow due to weak judicial implementation and many unreformed and inefficient state-owned enterprises. Vietnam's ranking may be only enhanced further if the government takes additional action to liberalize investment rules and reduce levels of corruption.
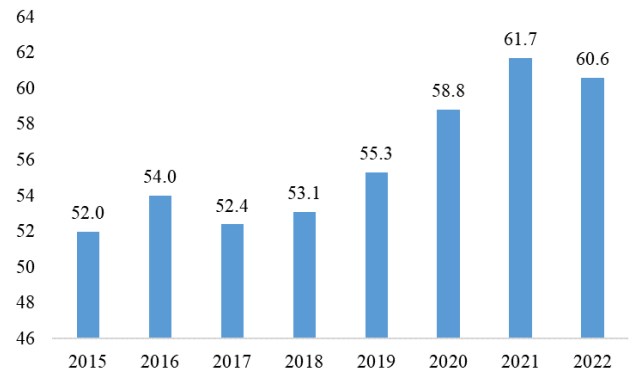


Source: The Heritage Foundation (2022)
Fig. 3. Vietnam's economic freedom index in 2015-2022

## VI. CONCLUSION

The aim of this paper is not to create a comprehensive checklist but instead to give valuable suggestions in terms of competition measures in developing countries. Based on discussing the advantages and limitations of competition indicators, the paper indicates that non-structural measures are more appropriate to estimate competition in developing countries than structural ones. Non-structural indicators do not impose stringent data requirements such as market share and defining relevant markets. They require information regarding business results, even in some cases, do not need product price information. Among the non-structural measures, the Boone indicator may be the most suitable metric since it has more advantages than the non-structural indexes. This indicator is also estimated by simple linear econometrics, thereby calculating and interpreting easily. Each non-structural only shows an aspect of competition and has its limitations. Therefore, in practice, applying non-structural indicators when estimating product market competition in developing countries depends on the aims of studies and specific conditions. Boone indicator is only our suggestion based on its benefits. If conditions permit, researchers should use a combination of different non-structural measures (Davies, 2021). We hope these findings may be valuable for future studies regarding product market competition in developing countries.

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